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BASELINE WATER RESOURCES SAMPLING AND ANALYSIS PLAN

ELKHORN GOLDFIELDS, INC. ELKHORN PROJECT

1.0 INTRODUCTION

Elkhorn Goldfields, Inc. is currently planning a mining operation in the historic Elkhorn Mining District near Elkhorn, Montana (Figure 1). The planned gold-mining operation will access several deposits located on private land. There are several small, but higher-grade deposits on private land that we are currently planning to mine using underground mining methods. Three or more underground developments are contemplated producing no more than 1000 tons per day depending upon development and production schedules. At this time our life-of-mine plan contemplates a 5 to 7 year mine life depending upon economic conditions, though this plan can be extended in continued exploration drilling discovers additional resources.

As part of pre-mining activities, Elkhorn Goldfields intends to characterize the current water quality of groundwater and surface water in areas that may potentially be impacted by mining operations. This Baseline Water Resources Sampling and Analysis Plan (SAP) has been prepared to guide the collection and analysis of groundwater and surface water samples from monitoring sites within and adjacent to the project area, for the purpose of assessing current water quality conditions.

A substantial database of surface water and groundwater chemistry data was generated during previous exploration and mine planning activities in the Elkhorn Mining District. Water quality monitoring conducted from 1989 through 1995 on behalf of the Santa Fe Pacific Gold Corporation was summarized in a comprehensive water resources report prepared by Maxim Technologies (1996). The monitoring proposed in this SAP will supplement the existing database, by retaining appropriate monitoring locations and a similar list of analytical parameters, including common constituents, nutrients, and metals.

2.0 SURFACE WATER MONITORING

Surface water monitoring in the vicinity of the Elkhorn Project from 1989-1995 was routinely conducted at 21 monitoring locations, along with 19 "supplemental" locations

where monitoring was less frequent (Maxim Technologies, 1996). Based on the location of the ore body and the proposed mining activities, seven (7) established surface water sites and one (1) new site have been selected for inclusion in this Baseline SAP. Surface water monitoring locations, methods, frequency, analytical parameters, and quality control samples are discussed below.

2.1 LOCATIONS AND METHODS

Baseline surface water monitoring locations are shown on Figure 2 and are described in Table 1. Sites SW-1, SW-2, SW-3, SW-6, SW-9, SW-10, and SW-11 were previously sampled during the 1989-1995 monitoring period. Site SP-1 is a spring located in a tributary drainage to Turnley Creek, and has been included due to its proximity to a potential land application disposal (LAD) area for water produced by mine dewatering. All surface water monitoring sites will be surveyed with a global positioning system (GPS) during the initial site visit.

Water quality samples will be collected from each surface water-monitoring site by passing an uncapped sample container across the area of flow, such that the sample is representative of the channel cross-section. If stream velocity or wading conditions preclude this technique, the sample will be collected from the center of the channel. When wading, samples are collected upstream of the sampler; during unsafe wading conditions, samples are collected from the stream bank. Sample containers will be rinsed three times with sample water prior to sample collection, and will be labeled with a unique sample identification number, the date and time of collection, the type of sample collected (preservation, filtered/unfiltered), and required analyses. Samples will be preserved in the field as appropriate for the intended analysis (e.g. nitric acid preservation to pH <2 for metals analysis), and stored on ice in coolers at approximately 4°C for transport. The samples will be stored in coolers or refrigerated from the time of collection until delivery to the analytical laboratory. Sample container and preservation requirements for each sample location are summarized below:

- Common Ions – 1000 mL plastic bottle, no preservative
- Nutrients – 250 mL plastic bottle, H₂SO₄ preservative
- Total Recoverable Metals – 250 mL plastic bottle, HNO₃ preservative

All water quality sampling information, including sample sites, sample numbers, date and time of sample collection, field parameter measurements, flow measurements, and other notes and observations, will be documented in waterproof ink in a dedicated project field notebook.

The parameters pH, specific conductance (SC), dissolved oxygen (DO), and water temperature will be measured at each site concurrently with sample collection. Field meters will be calibrated daily according to factory instructions, with calibration results recorded in the field notebook and on calibration forms. Dissolved oxygen and water temperature measurements are obtained directly in the stream or seep, if possible. For pH and SC measurements, a clean container will be filled with sample water for parameter measurement. Results are recorded in the field notebook and on standard sample forms.

Field meters are checked periodically throughout the day for drift by measuring standard solutions (pH buffers, SC standard solutions), and are recalibrated as necessary.

Surface water flow measurements will be collected using one of three methods, depending on the channel geometry and stream or seep discharge rate:

- Marsh-McBirney current meter and wading rod (velocity-area method);
- Portable trapezoidal flume; or
- Volumetric method.

If stream or seepage flow is too small to allow measurement by one of the above methods, or streamflow conditions preclude safe wading, flow will be estimated by the field sampling team.

The Marsh-McBirney current meter is used to measure streamflow at larger, wadeable stream sites. Measurement of streamflow is performed in accordance with the area-velocity method developed by the USGS (USGS, 1977). In general, the entire stream width is divided into subsections and the stream velocity measured at the midpoint of each subsection and at a depth equivalent to six-tenths of the total subsection depth. The velocity in each subsection is then multiplied by the cross-sectional area to obtain the flow volume through each subsection. The subsection flows are then summed to obtain the total streamflow rate. Streamflow measurements are typically collected in a stream reach as straight and free of obstructions as possible to minimize potential measurement error introduced by converging or turbulent flow paths.

Streamflow measurements on smaller streams or seeps will be obtained using a portable flume such as a 90° v-notch cutthroat flume. This flow measurement method is based on equations developed by Skogerboe et al (1967). To measure streamflow, the flume is placed and leveled in the streambed, and the full streamflow directed through the flume throat. Water depth or head measurements are then collected at specified locations in the upstream (H_a) and downstream (H_b) sections of the flume. The head measurements are used to verify proper functioning of the flume and to calculate streamflow.

Collection of volumetric flow measurements consists of directing the flow into a container of known volume (such as a five-gallon bucket or one liter sample bottle), and recording the time required to fill the known volume. Volumetric flow measurements are typically limited to monitoring points with small seepage flows or discrete discharge points (e.g. pipes).

2.2 MONITORING SCHEDULE

In order to obtain background water quality data under a variety of flow conditions, the baseline surface water sites will be sampled four times in 2006, as follows:

- March/April – coinciding with the early runoff period;
- May – coinciding with the peak of the annual hydrograph;

- June – coinciding with the falling limb (post-runoff) of the annual hydrograph; and
- September – coinciding with baseflow conditions.

Specific sampling dates will be dependent on site access and climatic conditions (precipitation patterns). Sampling will continue on this schedule beyond 2006 as necessary to provide operational monitoring for exploration and/or mining activities that are underway.

2.3 ANALYTICAL PARAMETERS

Surface water samples will be submitted to state-certified analytical laboratory, under standard chain-of-custody protocols, for analysis of common constituents, nutrients, and total recoverable metals. The analytical parameter list for the baseline water resources sampling is in Table 2. As noted in Table 2, a number of metals will be analyzed during the initial baseline monitoring event only, to confirm the results of previous monitoring. Subsequent baseline sampling events will likely not include these parameters, unless the initial sampling indicates their presence at detectable concentrations.

2.4 FIELD QUALITY CONTROL SAMPLES

Each surface water monitoring event will include collection of field quality control samples to aid in the assessment of overall data quality. One (1) field duplicate sample and one (1) field blank sample will be collected per monitoring event.

Field duplicate samples will be collected to estimate field and laboratory precision. Field duplicate samples will be collected by sequentially filling two sets of sample bottles at the same monitoring location, assigning unique sample numbers to the two samples, and submitting both samples to the laboratory for analysis.

Blank samples will be collected to estimate the potential for sample contamination from any materials contacting sample water (bottles, preservatives etc.) and from random atmospheric contamination. The blank sample will be collected by filling sample bottles with reagent-free deionized water in the field, preserving as appropriate, and submitting the sample blind to the laboratory for analysis.

3.0 GROUNDWATER MONITORING

Groundwater monitoring in the vicinity of the Elkhorn Project from 1989-1995 was routinely conducted at 12 monitoring locations (Maxim Technologies, 1996). Based on the location of the ore body and the proposed mining activities, five (5) established groundwater sites and one (1) new site, recently installed during aquifer testing at the proposed mine site, have been selected for inclusion in this Baseline SAP. Groundwater monitoring locations, methods, frequency, analytical parameters, and quality control samples are discussed below.

3.1 LOCATIONS AND METHODS

Baseline groundwater monitoring locations are shown on Figure 2 and are described (including completion details) in Table 3. Wells MW-2, MW-3, MW-5, MW-7, and MTHG-B were previously sampled during the 1989-1995 monitoring period. Site EGI-2 is a deep well installed in 2005 near the ore zone as part of the dewatering analysis for the mine. All groundwater monitoring sites will be surveyed with a GPS during the initial site visit.

Collection of groundwater samples will generally consist of three steps:

1. Measurement of static water level;
2. Well purging and monitoring for field parameter stabilization; and
3. Water quality sample collection.

Prior to collection of samples, static water level will be measured at each well using an electric water level probe to determine the depth to groundwater below a specified measuring point (typically the top of the PVC or steel well casing). Water level measurements will be combined with surveyed monitoring well elevations to compute groundwater elevations at each monitoring point. Water level measurements may also be collected during well purging and following groundwater sampling to assess well recovery.

Depending on the depth to groundwater, a submersible pump, peristaltic pump, or plastic bailers will be used to purge and sample wells. Purging will consist of removing three to five well volumes (including well casing and borehole annulus volume) while routinely monitoring field parameters (pH, dissolved oxygen, temperature, specific conductance) at least twice during removal of each well volume. Samples will be collected only after one of the following purge conditions is met:

- A minimum of three well volumes have been removed and successive field parameter measurements agree to within the stability criteria given below;
- At least five well volumes have been removed although field parameter stabilization criteria are not yet met; or
- The well has been bailed or pumped dry and allowed to recover sufficiently such that adequate sample volumes for rinsing equipment and collecting samples can be removed.

Criteria for field parameter stabilization are as follows:

Parameter (Units)	Stability Criteria
pH (standard units)	± 0.1 s.u.
water temperature (°C)	± 0.2 °C
specific conductance (µmhos/cm)	± 5% (SC ≤ 100 µmhos/cm) ± 3% (SC > 100 µmhos/cm)
dissolved oxygen (mg/L)	± 0.3 mg/L

NOTE: Stability criteria obtained from USGS *National Field Manual for the Collection*

Following well purging, final field parameter measurements will be collected and recorded, and groundwater quality samples will be obtained. Sample bottles will be filled directly from the pump or bailer discharge port.

General field parameter measurement and water quality sampling procedures have been presented in Section 2.1 above: sample containers will be rinsed three times with sample water prior to sample collection, then preserved as appropriate for the intended analysis (e.g. nitric acid preservation to pH <2 for metals analysis), and stored on ice in coolers at approximately 4°C for transport. Filtered samples (for dissolved metals analyses) will be processed through a single-use 0.45 µm pore-size disposable filter prior to preservation. Any groundwater sampling equipment reused between monitoring locations (e.g. pumps, discharge lines, etc.) will be thoroughly decontaminated between uses.

All groundwater quality sampling information, including sample sites, sample numbers, date and time of sample collection, field parameter measurements, static water level measurements, pumping rates, well purging information, and other notes and observations, will be documented in waterproof ink in a dedicated project field notebook.

3.2 MONITORING SCHEDULE

Baseline groundwater monitoring in 2006 will be conducted on a semiannual schedule. Monitoring will be conducted to coincide with the May and September surface water monitoring events; these monitoring events will presumably provide groundwater data during both high groundwater (May) and low groundwater (September) conditions. Monitoring will continue on this schedule beyond 2006 assuming that exploration and/or mining operations are underway. The schedule and monitoring plan may be updated to reflect any modifications that occur during the permitting process.

3.3 ANALYTICAL PARAMETERS

Groundwater samples will be submitted to a state-certified analytical laboratory under standard chain-of-custody protocols, for analysis of common constituents, nutrients, and dissolved metals. The parameter list for groundwater samples will be identical to that for surface water samples (Table 2), with the exception that metals analyses for groundwater samples will be for the dissolved fraction. As noted above, groundwater metals samples will be filtered in the field (using a 0.45 µm filter) prior to preserving with nitric acid.

As with surface water samples, a number of metals will be analyzed during the initial baseline groundwater monitoring event only, to confirm the results of previous monitoring (Table 2). Subsequent baseline sampling events will likely not include these parameters, unless the initial sampling indicates their presence at detectable concentrations.

3.4 FIELD QUALITY CONTROL SAMPLES

Each groundwater monitoring event will include collection of field quality control samples to aid in the assessment of overall data quality. One (1) field duplicate sample and one (1) field blank sample will be collected per monitoring event.

Field duplicate samples will be collected to estimate field and laboratory precision. Field duplicate samples will be collected by sequentially filling two sets of sample bottles at the same monitoring location, assigning unique sample numbers to the two samples, and submitting both samples to the laboratory for analysis.

Blank samples will be collected to estimate the potential for sample contamination from any materials contacting sample water (filtration equipment, bottles, preservatives etc.) and from random atmospheric contamination. The blank sample will be collected by filling sample bottles with reagent-free deionized water in the field (processed through filtration equipment for the metals sample), preserving as appropriate, and submitting the sample blind to the laboratory for analysis.

4.0 DATA REVIEW AND REPORTING

Following receipt of laboratory reports, all field and laboratory documentation and data will be reviewed for completeness based on the requirements of this SAP. Field and laboratory quality control data will be reviewed and compared with EPA-suggested target control limits. Target control limits for field blanks (both deionized water and equipment rinsate blanks) are no contaminants present above laboratory detection limits. Target duplicate sample control limits for inorganic water constituents will be as follows (EPA, 2002):

- Water Sample Duplicates (surface water and groundwater): Control limit of $\pm 20\%$ relative percent difference (RPD) for original and duplicate samples with concentrations greater than 5 times the laboratory detection limit (DL); or control limit of \pm DL if the original or duplicate/split concentration is less than 5 times the DL.

Relative percent difference is calculated as follows:

$$RPD = \frac{|S - D|}{\frac{(S+D)}{2}} \times 100$$

where RPD = relative percent difference (%)
S = original sample result; and
D = duplicate sample result.

All baseline water resources data collected during 2006 will be stored in spreadsheet/database format to facilitate production of data summary tables and figures, as well as comparison with previous data (Maxim Technologies, 1996) as warranted.

5.0 REFERENCES

- Maxim Technologies, Inc., 1996. *Comprehensive Report for the Water Resources Monitoring Program: 1989-1995. Elkhorn Project, Montana.* Prepared for Santa Fe Pacific Gold Corporation. March 1996.
- Skogerboe et al., 1967. Design and Calibration of Submerged Open Channel Flow Measurement Structures: Part 3, Cutthroat Flumes. Utah Water Research Laboratory, Utah State University, April 1967.
- USGS, 1977. National Handbook of Recommended Methods for Water-Data Acquisition. Office of Water Data Coordination, 1977 (with subsequent revisions through 1983).

TABLES

Table 1. Baseline Surface Water Quality Monitoring Locations

Site ID	Description
SW-1	Slaughterhouse Gulch, upstream
SW-2	Slaughterhouse Gulch, above county road
SW-3	Slaughterhouse Gulch spring house
SW-6	Turnley Creek upstream of confluence with Elkhorn Creek
SW-9	Greyback Gulch upstream of confluence with Sourdough Creek
SW-10	Abandoned adit seepage to Greyback Gulch
SW-11	Greyback Gulch upstream of mine area
SP-1	Spring in Turnley Creek drainage

**Table 2. Elkhorn Goldfields Baseline Water Resources Monitoring
Analytical Parameter List**

<i>Field Parameters</i>	<i>Common Constituents</i>	<i>Metals[#]</i>	<i>Nutrients</i>
pH	Calcium (1.0)	Arsenic (0.001)	Nitrate + Nitrite as N (0.05)
SC (µmhos/cm)	Magnesium (1.0)	Aluminum (0.1)**	Ammonia N (0.05)
Dissolved Oxygen	Sodium (1.0)	Cadmium (0.0001)	Total Phosphorus as P (0.01)
Water Temperature	Potassium (1.0)	Chromium (0.001)**	
Static Water Level (gw)	Carbonate (1.0)	Copper (0.001)	
Flow (sw)	Bicarbonate (1.0)	Iron (0.03)	
	Chloride (1.0)	Lead (0.002)	
	Sulfate SO ₄ (1.0)	Manganese (0.01)	
	Total Dissolved Solids (1.0)	Mercury (0.0002)	
	Total Suspended Solids (1.0)	Molybdenum (0.005)**	
	Alkalinity as CaCO ₃ (1.0)	Nickel (0.005)**	
		Selenium (0.001)**	
		Silver (0.0005)	
		Zinc (0.005)	
		Antimony (0.005)**	
		Beryllium (0.001)**	
		Thallium (0.002)**	
		Barium (0.1)**	

[#]Metals will be analyzed as total recoverable in surface water, dissolved in groundwater.

**Indicates parameter to be analyzed during initial sampling event only to confirm results of previous baseline sampling. Subsequent sampling will not include these parameters.

Table 3. Baseline Groundwater Quality Monitoring Locations

Site ID	Casing Diameter (in)	Total Depth (ft)	Screen Interval (ft)	Geologic Unit	Description
MW-2	4	180	40-180	Quartz Monzonite	Greyback Gulch
MW-3	4	155	40-155	Skarn	Upper Slaughterhouse Gulch
MW-5	4	125	20-125	Argillite/Exoskarn	Lower Slaughterhouse Gulch
MW-7	6	185	165-185	Quartz Monzonite	Elkhorn Well
MTHG-B	6	400	20-400	Endoskarn	Mt. Heggen Well adjacent to pit
EGI-2					

FIGURES